Thermal Conductivity Measurements of Rare Earth Element Salts in Aqueous Solutions

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An experimental apparatus realizing an absolute technique of coaxial cylinders was used for measurements of the thermal conductivity coefficient (λ) of aqueous salt solutions $La(NO_3)_3*6H_2O$, $Sm(NO_3)_3*6H_2O$, $Tb(NO_3)_3*5H_2O$, $Lu(NO_3)_3*4H_2O$. The region studied comprises the temperature range T=293 to 493 K and the pressure range P=0.1 to 100 MPa. The error of an individual measurement of λ did not exceed ±1.3%. The analysis of experimental results and grapho-analytical handling of experimental data showed that, with the increase of salts concentration, the thermal conductivity of the solutions decrease monotonically. With an increase of temperature and pressure, the character of concentration dependence does not change substantially.

The thermal conductivity isobars, at certain values of temperature, have maxima, the positions of which depend on the concentration of the diluted salts. With an increase of pressure, the displacement of the λ maxima into the region of higher pressures is observed. Isotherms of λ are the curves bent relative to the axis of pressure. An attempt has been made for obtaining a generalized equation for the calculation of λ for lantanoids/salt solutions. Problems in predicting the thermal conductivity of lantanoids/salts at higher pressures are also treated.